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CORRESPONDENCE.

Concerning the Review of Jones' The Gas Engine.

Sir: Relative to "The Gas Engine" by Forrest R. Jones, as reviewed by Mr. Lional S. Marks, Assistant Professor of Mechanical Engineering, Harvard University, which appeared in your publication:

The reviewer appears much concerned with what he calls "failure of the author in philosophic arrangement of his matter," and makes several misstatements to verify his point of view. One of the reviewer's misstatements relative to this feature is "it is not till near the end that pressure-volume diagrams are explained and gas-engine cycles considered." This statement is made despite the fact that practical gas-engine cycles are explained on pages 5 to 40 of the book. The reviewer evidently labors under the delusion that a heat cycle can be only theoretical. Another misstatement of the reviewer's, referring to the second chapter, is:

> The first thing dealt with is the primer for a carbureter; and that before the carbureter itself has been described. No reference is made to the primer, which is shown in a figure two pages later, although such reference would have made the matter much more clear than the description of it as "a simple hand-operated arrangement" that does certain things.

As a matter of fact the first page of the chapter is devoted to, first a brief statement of the function and method of operating carbureters, and, second, to a still more brief statement of the function of the primer and its simplicity. On the following page is an illustration of an elementary form of carbureter and an explanation of its operation, including the method of obtaining a sufficiently rich combustible mixture when starting the motor, which method is analogous to that of priming. And on the third page of the chapter is an illustration of a very complete carbureter in which the priming device is designated by reference numbers which are used in its description on the same page. The reviewer is apparently not aware of the fact that the primer is sometimes only an extension of the spindle on which the float is mounted. Still another misstatement of the reviewer is "Of the fifty pages of the chapter on governors and governing, twelve are used for unrelated illustrations and descriptive matter of one special engine." In the first place the engine illustrated is not special, but of a type for general power purposes, and is the regular product of one of the largest American builders of large stationary gas engines; and in the second place, seven of the nine full-page illustrations show different views of the governing mechanism, and three of the seven are solely of the distinctive form of valves used to secure the means of governing.

The reviewer states, in confused language:

> Economy is defined as either fuel consumption per unit of power or as the heat value of the same quantity.

The statement that appears in the book is:

> The unqualified terms *fuel economy of motor* and *motor economy* will be taken to mean either the amount of fuel or the heat value of all the fuel supplied to the motor per delivered HP. per hour.

The reviewer evidently needs to add to his knowledge the well-known elementary fact that the term power, as used in connection with motors, relates to a rate of transmission of energy, and that time must be taken into consideration in conjunction with power when dealing with economy.

Again from the review: "A simple mathematical treatment gives the speed variation at various loads in make-and-break governing." This is news to the author. He never before heard of *make-and-break governing*. The reviewer is evidently misty as to make-and-break electric ignition and hit-or-miss governing. If he is not, an explanation of "make-and-break governing" would doubtless be welcome and enlightening to the members of the engineering profession.

The reviewer says:

> In considering the effect of humidity of the air on the power of a gasoline engine the author has failed to realize that gasoline and water are partly miscible, and consequently that the partial pressure of the gasoline vapor depends on the partial pressure of the water vapor present; that is, on the humidity of the air. The explanation which he gives is not correct.

The reviewer evidently fails completely to comprehend the conditions, which are those of ordinary operation of a gasoline motor. Apparently he does not realize that the temperature of the charge in the motor cylinder is so much higher than that of the atmosphere at the instant the inlet port closes that the charge at that instant is not saturated with moisture although the atmosphere is at 100% humidity and the liquid gasoline used has mixed with it the greatest amount of water that it can take into intimate mixture while in the liquid state; also that there is no liquid gasoline present in the motor cylinder.

The conclusion of the reviewer is:

> On the whole this book is a useful contribution to gas-engine literature, but only from the operative standpoint. In that particular it occupies a place by itself.

It is to be wondered what would be his conclusion if the 64 pages on operation and the 26 pages on results of trials were omitted, thus leaving 340 pages relating to description, operation and theory. The operative chapters can be omitted without affecting the remainder of the matter presented.

Forrest R. Jones.

1702 Melrose Pl., Knoxville, Tenn., June 14, 1909.

[Proof of the foregoing letter having been submitted to Prof. Marks, he has replied as follows.—Ed.]

Sir: Mr. Jones has pointed out one detail in which I am in error. As he surmises, "make-and-break governing" was a miswriting for hit-and-miss governing. I hope, in view of the fallibility of all things human, that he will forgive me that.

As to the other points which he raises those who read the book may judge for themselves. I have had the pleasure of recommending the Jones book to a number of persons interested in the practical operation of gas engines. I can only regret that I do not find it equally admirable in all its parts.

Yours very truly,

Lionel S. Marks.

Cambridge, Mass., June 28, 1909.

Comments on the Review of "The Economy Factor in Steam Power Plants."

Sir: Owing to a long absence, I have just seen the review of "The Economy Factor in Steam Power Plants," by Prof. Lionel S. Marks, which was published in your issue of March 18, 1909. It is very often the case where a treatise upon a highly specialized subject is criticized by one of a general training, only, that the reviewer is apt to be led into errors or inaccuracies.

Prof. Marks thinks the title of the book is misleading. The "Economy Factor," he believes, has to do with the total cost of production of power of which the fuel bill is only a part. I think it is safe to assert, however, that among power-plant men the expression is always understood in its limited sense. When one speaks of the "economy of a power plant," any other idea than the fuel consumption is rarely involved. It is not a question of definition, it is a question of specialization, of customary application.

The reviewer fails to discriminate between two separate and distinct subjects, when he mentioned Mr. R. H. Smith's valuable treatise, which is not a specialized analysis of the economies of the various types of plants and of steam-power generating machinery. It is also a fact that "The Economy Factor in Steam Power Plants" was in the press before the Redondo plant was completed—let alone tested.

Prof. Marks' opinions upon water-tube boiler efficiencies and oil burning are really not very well defined. As a matter of fact authentic records can be produced showing a boiler efficiency of 85.6%. Of course it is not claimed that such results can be maintained in commercial operation, but due to the ease of regulation with oil fuel, skilled firemen can approach these figures with remarkable proximity.

Prof. Marks states that "full justice" is meted out to the steam consumption and efficiency of McIntosh and Seymour engines, but that the performance of steam turbines has been underrated. The results quoted as doing "full justice" to the engines have been very considerably bettered under test conditions. It should be remembered that the public has very little definite information regarding the economy of large units, either reciprocating engines or turbines, and I am very sure that if I could have the pleasure of reviewing the results of certain authentic tests with Prof. Marks he would be led to modify his views. As in the case of the boiler efficiencies given, the engine and turbine results are intended not to represent the very highest results that have been obtained, but the results that are to be conservatively expected from the best types of units under good test conditions.

Prof. Marks mentions a turbine economy of 14 lbs. per KW.-hr. for an 8,000-KW. unit "with superheat and vacuum slightly better" than the conditions defined in "The Economy Factor in Steam Power Plants" for a much smaller unit. But it should be remembered that when these results are reduced to the same basis (say compared with the Rankine cycle) the economies do not show up any better, if as well, than apparently larger steam consumptions with more moderate operating conditions. It should also be remembered that when high vacuums are reached any "slightly better" vacuum is obtained at very much more than a slightly greater expense. The writer has seen, as Prof. Marks also surely has, reported turbine results much better than 14 lbs.; such, for instance, as 12.9 and 13 lbs. per KW.-hr. On the other hand, a certain triple-expansion engine is reported as producing 1 I.HP. hr. on something like 8 lbs. of superheated steam.

All of this, however, forms a complicated question, regarding which there is a great diversity of opinion, and the writer expected to be much criticized on the stand he has taken. Nevertheless, he happens to be in a position where data not possessed by all is available and feels very confident that future results will justify his position.

Prof. Marks states that he does not know whether the steam consumption of a feed pump is 80 or 240 lbs. per I.HP.-hr. and urges this as a reason for the uselessness of accuracy in developing the formulas submitted for power-plant economy. Perhaps some engineers are able to estimate this steam consumption a little more accurately. In any event, the assumption of a fixed percentage of the total steam consumption of the plant for this item, as advocated by Prof. Marks, is grievously in error, as the value varies all the way from 1 to 6%, depending upon the size and type of plant and feed pump.

Prof. Marks seems to think it is a simple matter to determine the fuel consumption of the various types of plants under all conditions of operation. In this opinion he is at variance with our most prominent engineers, who devote a very large percentage of their time to this subject.

How Prof. Marks can interpret the author's statement to the effect that the fuel consumption of a plant varies inversely as the factor of evaporation, in any other way than the way it is meant seems difficult to understand. It is of course granted that the relation only holds true, *other things being equal*.

Again, Prof. Marks advocates inaccuracy in one case and extreme accuracy in the other. In his efforts toward the latter he states that "the efficiency of a perfect engine using superheated steam is given as $\frac{t_1 - t_2}{t_1}$." This is, to say the least, incorrect. No such error is made. The author did make use of the well-known thermal formula simply to illustrate the economic benefit of an increased temperature of the steam at admission, but did not say that the relation held good under superheated steam conditions, which would be obviously wrong.

Finally, it does seem strange to the writer that Prof. Marks should so signally fail to discriminate between two subjects so entirely different. He persists in deploring the lack of data in the book relating to first cost, fixed charges, labor, supplies, etc. Cannot he realize that this is distinctly another subject entirely outside of the province of this particular book? As a matter of fact, data upon these questions is extremely variable in its very nature and both temporary and local in value, whereas the fuel economy of a plant is fairly constant regardless of its location.

The writer dislikes to enter into a public argument upon a matter of this kind, particularly where the subject under discussion is a book of his own writing, but some of the criticisms pointed out above appear to be so unwarranted that he feels called upon to place the matter in its proper light.

Yours very truly,
Geo. W. Hawkins.

99 First St., San Francisco, Cal., June 5, 1909.

[In accordance with our usual custom we submitted proof of the above letter to Prof. Marks, whose reply is as follows.—Ed.]

Sir: I am sorry that Mr. Hawkins finds so much to criticize in my review of his book. Our differences of opinion appear primarily to be due to differences in understanding of terms or phrases. With reference to the two alleged misstatements of the contents of the book, I think the author will find that whatever his intentions may have been, the text actually justifies the conclusions I have drawn.

Yours very truly,
Lionel S. Marks.

Cambridge, Mass., June 30, 1909.

REVIEWS.

Marine Propulsion.

Reviewed by D. W. TAYLOR.*

THE SCREW PROPELLER.—And Other Competing Instruments for Marine Propulsion. By A. E. Seaton, M. Inst. C. E., M. Inst. M. E., Author of "A Manual of Marine Engineering," etc. London, England: Charles Griffin & Co., Ltd. Philadelphia, Pa.: J. B Lippincott Co. Cloth; 6¼ × 9¼ ins.; pp. 255; 7 plates, 65 text illustrations and 60 tables. $4, net.

This work is an expansion of the portion of the author's Manual of Marine Engineering which dealt with the subject matter. While its main subject is the screw propeller, there is space devoted to the resistance of ships, to paddle-wheel propulsion and to hydraulic propulsion.

The author does not attempt to go into "the more abstruse and highly mathematical investigations connected with the theory of resistance of ships and propellers," his idea being, in such connection, to give formulas which are more or less empirical, with coefficients and constants based upon good practice.

The first two chapters are devoted to the "early" history of marine propellers and the "modern" early history of propellers. The early history covers the development of steam navigation up to 1822, including many ideas of antiquity which were never carried out in practice. It is to be noted that the author, although stating that a vessel was built in Great Britain in 1802, which might have been used for regular service, appears to concede that Fulton's "Clermont" of 1807 was the first steamer used commercially.

Under modern history of propellers, there is considered the development of propellers only to 1875, there being little or nothing concerning more recent developments.

It is interesting to note that in 1824 a patent was taken out by Jacob Perkins for the arrangement of right- and left-handed propellers, one behind the other, on concentric shafts. Patents including this right- and left-handed screw combination were taken out by Ericsson in 1836, George Smith in 1838 and others. This arrangement has never been used in practice except to drive torpedoes. Curiously enough, however, this combination, nearly a hundred years old, has recently been advocated by a prominent Italian naval architect who read a paper on the subject a few months ago before the Institution of Naval Architects.

In the chapter of 16 pages upon Resistance of Ships semi-empirical methods are followed, the formulas given being of little practical use unless coefficients are used from ships very similar to that under consideration. The method apparently favored is to estimate the resistance per square foot at ten knots from the nature of the surface and then assume that for other speeds the resistance varies as the square of the speed. This is practically the old Admiralty coefficient method, as modified by Kirk, which gives good results only when coefficients are available from ships of type and relative speed practically identical with the one under consideration.

*Naval Constructor, U. S. N., U. S. Navy Yard, Washington, D. C.

On page 46 there is a curious blunder. The author gives Froude's frictional constants and then states that more recent investigations have shown that Froude's index of 1.825 for variation of frictional resistance with speed requires modification and should be 1.829, 1.827 or 1.843, according to the nature of the bottom. As a matter of fact, the Froude constants were published by the younger Froude about 1886, whereas the other indexes stated to have been derived from "more recent investigations" are Tideman's indexes published soon after his experiments about 1874.

Chapter 4, of 15 pages, on slip, cavitation, and racing, has the greater portion devoted to the question of negative slip, its probable causes, etc. This was a burning question about 1860, but has been little dealt with of recent years.

While the author gives a number of possible causes of negative slip his conclusions are not very definite, though in a few words on page 62 he refers to the dominant factor where he says, "especially is it open to doubt if the effective pitch even approximates to that of its acting face or designed pitch." Recent experimental investigations have demonstrated that the virtual or effective pitch of the screw propeller, especially with rather thick blades, is materially greater than the nominal pitch of its face, owing to the action of the back of the blades, and that this is the main reason for the apparent negative slip based upon nominal pitch which has been often observed. It is a remarkable fact that until a few years ago writers upon the propeller almost without exception ignored the action of the back of a propeller blade, discussing the subject from consideration of the face, only. While considering at length negative slip, less than two pages are devoted to the question of cavitation, which is now and has been for several years past a very important and puzzling question in connection with high-speed screw propellers. The author contributes nothing to the elucidation of this puzzle.

The treatment of paddle-wheels in chapters 5 and 6, while brief, is excellent, and the more or less empirical formulas given cover the ground well. The paddle-wheel is a propelling instrument which lends itself to this method of treatment.

Under hydraulic propulsion the author gives much historical information, including the classical Waterwitch experiments of 1866, which fully demonstrated the essential inefficiency in practice of this method of propulsion.

The screw propeller proper is then taken up and treated as to its leading features and characteristics: the various forms of propellers, the number and position of screws, the number, shape and proportions of screw-propeller blades, the details and dimensions of screw propellers, the geometry of the screw and the materials of construction.

Much practical information of value and interest is given as well as semi-empirical formulas and rules for determining diameter and area of screws. Curiously enough, the question of the proper pitch of a screw to meet given conditions is practically ignored. Though some of the formulas given involve pitch, it would be very difficult for the designer to determine a suitable pitch from them. As illustrating the author's methods mention may be made of his formula for determining the diameter of a screw, as given on page 171:

$$\text{Diameter of screw in feet} = X\, P_c 3\sqrt{\frac{\text{I. HP.}}{R}}$$

in which R denotes revolutions per minute, P_c is the prismatic coefficient of the ship and X is a coefficient whose values, as given, range from 5.75 to 7.61 for various types of ships. The values given for the coefficient X are taken, of course, from the author's experience with successful ships, and there is no doubt that for vessels not of novel type this formula would give reasonably approximate results. The inclusion of the prismatic coefficient as an important factor in propeller diameter appears remarkable, its influence in this connection being seemingly somewhat remote. Probably, however, the use of the prismatic coefficient reduces the variation of X which would presumably be much [illegible] for fast vessels with fine prismatic coefficients than for slow ships with full prismatic coefficients, unless the prismatic coefficient had been incorporated in the formula.

The author gives little attention to the modern experimental investigations of propellers, although he devotes a chapter of seven pages to experiments with 6-in. models, made in 1904 by Mr. Charles Sells, of Maudslay, Sons & Field. Mr. R. E. Froude's very valuable paper in 1908, before the Institution of Naval Architects, however, abstracted in three pages, though it is not reduced to forms for practical application and there is a blunder in Table 8 (page 121), where coefficients given by Froude for three-bladed elliptical screws are stated to characterize four-bladed elliptical screws.

The three concluding chapters are devoted to various experimental results and trials of ships, nearly all now antiquated, though of historical value. For instance, the comparative experiments made by the Admiralty about 1840 between the paddle and the screw propeller as methods of propulsion are treated in full.

The book concludes with tables of propeller data and performance for a number of vessels of the mercantile marine and English Navy.

There are a number of typographical and clerical errors, some of which are important. On page 8 the author speaks of an inventor as James Rumsey in one place and James Rumsay in another place, and on page 92 the same inventor is called James Ramsay. On page 39 there is an error in the formula for the resistance of planes. On page 59, second line from the bottom of the third paragraph, the word "negative" has been omitted after "apparent." On page 65, tenth line from the bottom, "pitch" is used where "slip" is meant. On page 124, example 1, 48 should be 46⅔. On page 171, Rule 2, $\sqrt{\frac{\text{I. HP.}}{R}}$ should be $3\sqrt{\frac{\text{I. HP.}}{R}}$

This error is in a very important formula. On page 177, when considering blade sections, the author recommends placing the maximum thickness of the blade closer to the leading than to the following edge. Many engineers would disagree with him, and while in slow-turning, low-powered screws it probably makes no material difference, there is little doubt that any one who follows this dictum for quick-running hard-pressed screws is laying up trouble for himself.

While this book is avowedly deficient from the scientific side, it contains a great deal of valuable practical information, and its empirical and semi-empirical formulas, being based upon wide experience, are of value, though not to be trusted implicitly. The large amount of information given concerning antiquated experiments and practice is of historical interest. For designing, it will be very useful to those dealing with moderate-speed mercantile jobs but of almost no use in connection with high-speed men-of-war or turbine jobs.

While the meaning is obscure in a few places, the book as a whole is clear and well written. It is interspersed here and there by pungent characteristic comments. Thus on page 163 we find the following:

> With practical sea-going engineers of the mercantile marine, young and old, it is an axiom that a sea-going, that is, ocean-crossing, ship, must have four-bladed screws, and that monster with its four great wings has almost become a fetish to many of them.
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> * * * * * * *
>
> The shape of screw blades best suited for each type of ship and condition of work is a problem that may be worked out some day by some one whose leisure equals his knowledge of mathematical science. Judging by everyday experience, however, there does not appear to be much scope for anything but small refinements.

AZIMUTH.—By George L. Hosmer, Assistant Professor of Civil Engineering, Massachusetts Institute of Technology. New York: John Wiley & Sons. London, England: Chapman & Hall, Ltd. Flexible leather; 4½ × 7¼ ins.; pp. 73; 6 text illustrations and 19 tables. $1; English price, 4s. 6d., net.

This is a very compact and complete handbook of methods to be applied in determining the azimuth of a line. It includes all of the precise and approximate methods of observation with the ordinary transit together with the necessary tables.

Tar Macadam.

DUSTLESS ROADS—TAR MACADAM.—A Practical Treatise for Engineers, Surveyors and Others. By J. Walker Smith, City Engineer, Edinburgh. London, England: Charles Griffin & Co., Ltd. Philadelphia, Pa.: J. B. Lippincott Co. Cloth; 6 × 9 ins.; pp. 225; 24 illustrations, partly in the text, and folding sheets. $3.50, net.

It is a pity that there are not more technical books based, as this one has been, so largely upon a long-continued intimate personal experience in dealing with the subject treated. Such a foundation is particularly desirable in the case of a book dealing with a relatively new subject, or one on which comparatively little serviceable information is available. As an art or science develops, it of course becomes more and more desirable to present the consensus of opinion with increasing disregard for mere personal ideas or experiences—although in engineering, at least, more or less information based on recent personal experience and practice is always interesting and generally very valuable.

Judging from a large part of the contents of this book, Mr. Smith has virtually lived with and amidst tar macadam work and problems for a number of years past. He does not, however, confine himself wholly to his own experiences and ideas, although, as stated, these form the basis for a large part of the book.

In the opening chapter the author deals with the general question of tar macadam as a remedy for the dust nuisance; that is, so far as the dust nuisance is concerned he goes to the root of the matter and proposes to make, as nearly as possible, a dustless road instead of providing palliatives in the way of dust layers. He also deals in this chapter with the very important and much neglected subject of the "Necessity for Standardization in Construction of Tar Macadam Roads."

After having set forth the general aspects of the subject, the author then takes up in detail its various phases. In doing this he begins at the beginning, so to speak, by devoting over 30 pages to the production and refinement of tar. In this chapter he gives in condensed form a considerable amount of information which it is desirable that every engineer using tar in road construction should know. He then takes up in succession the standardization of the matrix and associated tests, the aggregate, the different methods of preparing and laying tar macadam (four chapters), and mechanical mixing. Later in the book, wearing and tractive effort is considered, but before coming to that subject the author takes up the effects of wear, porosity, density, and distribution of weight; scavenging or road cleaning, watering, and maintenance generally; camber or crown, grade, noiselessness, and hygienic advantages. Near the end of the book there is a chapter devoted to statistics of road mileage in England and Wales, costs of maintenance gross and per mile, all classified by different grades of municipalities and by main and country roads. Some very interesting estimates are presented to show the ultimate economy over a considerable period of years of reconstructing existing ordinary macadam roads with tar macadam. Tables are presented for the various classes of roads in England showing year by year the gross and net financial outcome of such a scheme.

The final chapter is entitled "Tar Spraying or Spreading Ordinary Macadam Surfaces." As already intimated, the author believes in building and rebuilding roads with tar macadam rather than adopting any palliative for dust, but of course there are conditions where surface treatment may be desirable for a time. The chapter contains considerable valuable information on tar spraying, as well as an interesting but very brief history of the practice.

An appendix gives in tabulated form replies received to inquiries regarding "tar macadam and the tarring of macadam surfaces," made by various British municipal engineers. These returns, it may be added, are drawn upon by the author from time to time throughout a large part of his text, thus supplementing his long experience and ideas with those of others.

The serviceability of the book is slightly impaired by an unfortunate lack of attention to proper paragraphing.

The book contains scarcely a reference to any other form of dustless road construction or dust palliative other than those which involve the use of tar. This is perhaps wholly excusable in a book written for British engineers and municipal authorities; but of course it leaves untouched many questions of dustless road construction and dust laying which arise in this country, where other bituminous cementing materials than tar are widely exploited and have been used to a considerable extent. These facts, however, cannot be said to detract from the value of the book, but rather merely to suggest the need of a supplementary volume to cover American materials other than tar or else to embrace the whole field. Until such a book has been written, and even after anything of the sort has been produced which we can foresee, this volume will prove of great interest and value to American engineers and local authorities engaged in road construction and maintenance. We wish there were more engineering books equally satisfactory in character.

INTRODUCTION TO THE CHEMISTRY AND PHYSICS OF BUILDING MATERIALS.—By Alan E. Munby, Author of "Simple Experiments in Magnetism and Electricity," etc. New York: D. Van Nostrand Co. Cloth; 5½ × 8¼ ins.; pp. 345; nine illustrations in the text. $2, net.

The author's aim is to enable any one with no knowledge of natural science whatever to appreciate something of the chemical and physical principles which underlie the use of building materials.

At first glance this would seem to be quite simple, but an examination of the book shows that the field to be covered is of such extent that reduction to so small compass is difficult. Furthermore, the simplification of science for the lay mind is about the hardest problem to set before an author, because the rejection of the complicated generally results in such an emasculated version that the original theory is hardly recognizable.

In the present instance the author has succeeded remarkably well in presenting in a limited space—limited, that is, considering the breadth of the subject—so complete and clear a discussion. There is a chance that still there are parts where one not acquainted with the elements of chemistry may have trouble with the text but such places are probably unavoidable.

The book starts with general statements regarding the foundations of natural science; i. e., the simple processes of heat, light, measurements, etc., and then takes up the air; heat, and its effect on materials; chemical signs and applications; water; acids and bases; coal and, finally, the outlines of geology. This is all preliminary to the study of the materials proper. In the main part of the book, there follows chapters on stones, clays, plaster, limes, cements, iron, steel and other metals, timber and paints. An ambitious program, it can readily be seen for a 345-pp. book, but one consistently carried out. As preliminary reading it has a field.

RAILROAD PROMOTION AND CAPITALIZATION IN THE UNITED STATES.—By Frederick A. Cleveland, Ph. D., and Fred Wilbur Powell, A. M. New York, London and Bombay: Longmans, Green & Co. Cloth; 5¼ × 8 ins.; pp. 368. $2, net.

Every engineer who has been engaged in railway construction, and particularly those who have spent long years in that work, will read this book with great interest. Its contents are broader than its title implies. A large part of it is of historical interest, and, besides its record of railway development in the United States, it contains much valuable material concerning the early canal enterprises.

Dr. F. A. Cleveland, the chief author, is a well-known economist and has been for a number of years Professor of Finance in the School of Commerce of New York University. His associate, Mr. F. W. Powell, has collected material for the historical part of the work from early periodicals and documents scattered through many libraries, and this expensive part of the work of preparing the volume has been made possible by funds furnished by the Carnegie Institution.

The book is written in most entertaining style. It ought to be included in every engineering reference library and the library of every engineering school; in fact, we may go further and say that in the development of courses of business engineering in our engineering schools, this book may well be placed upon the list of works which the student should be required to read.

THE FIRE-RESISTIVE PROPERTIES OF VARIOUS BUILDING MATERIALS.—By Richard L. Humphrey. Bulletin 370, U. S. Geological Survey; George Otis Smith, Director. Washington, D. C.: Pub. Doc. Paper; 5¼ × 9¼ ins.; pp. 99; 39 plates, 32 text illustrations and 14 tables.

The scope of this report is outlined in the following extract from the introduction:

This bulletin contains the results of tests of 30 panels of various building materials, made by the United States Geological Survey with a furnace in the Underwriters' Laboratories, Chicago, Ill., to determine the effect of fire and subsequent quenching with water on mortar building blocks made of river and slag sands, common, hydraulic-pressed, and sand-lime brick, gravel cinder, limestone, and granite concrete, glazed building and partition terra cotta tile, and limestone, sandstone, granite, and marble building stone. The mortar building blocks and the concrete were made in the [U. S.] Structural-Materials Testing Laboratories [at St. Louis]; the other materials, except some of the common brick, were obtained in the open market at Chicago, Ill.

The log of each test is most complete and accompanied in nearly every instance with temperature curves and photographs of the panel before or after the text. Nothing but general deductions are given but the material obtained is most valuable in the study of fireproofing and protection.

BROWN'S DIRECTORY OF AMERICAN GAS COMPANIES.—Gas Statistics. [1909] Compiled and Corrected Annually by E. C. Brown. New York: "Progressive Age." Cloth; 6½ × 10 ins.; pp. 417. $5.

Much the same lines are followed in this issue of the "Directory" as have been noted in previous years. Besides giving the names of the officials of the various companies, including purchasing agents, there is included for each company listed its capital stock and bonded indebtedness, the process of manufacture used, prices of coal and oil, population supplied, some figures relating to the size and capacity of the works, and the prices charged for gas. Where the same company operates an electrical department, information regarding that department is given.

There are sections on natural gas, acetylene plants for town lighting, and also gasoline town plants. An appendix gives brief statements regarding the history and financial status of a number of companies. The usual directories of various gas associations are included. There is also a list of books for gas-men, with imprint facts and prices.

On the whole, this issue of the "Directory" seems to maintain its record of continued improvement on previous editions. It still lacks, however, what we have previously noted as an unfortunate omission which could be supplied with very little trouble, namely, anything whatever in the way of a summary by states of the number of works included and their division between municipal and private ownership. Other useful summaries might also be introduced.

TIMBER.—By J. R. Baterden, Assoc. M. Inst. C. E. New York: D. Van Nostrand Co. Cloth; 5½ × 8¼ ins.; pp. 351; 54 illustrations in the text. $2, net.

By far the greater part of this volume is taken up with descriptions of the commercial timbers of the various countries of the world. About 55 pages are given to the United States and Canada. Of the two introductory chapters, one deals briefly with timber in general, including some of its uses and structural characteristics, and the other considers even more briefly the world's forest supply and the quantities of timber imported into Great Britain. Five chapters which follow the description of timbers by country deal with the decay and destruction of timber, seasoning and impregnation, defects, strength and testing, and "figure" in timber and the way of bringing it out by various methods of cutting.

The book shows intelligent use of a wide range of information, and promises to be of interest and at least general usefulness to purchasers and users of timber throughout the world.

Testing Gas and Gas Meters.

Reviewed by ALFRED E. FORSTALL.*

PRACTICAL TESTING OF GAS AND GAS METERS.—By C. H. Stone, Chief Inspector of Gas, Public Service Commission, Second District, New York. New York: John Wiley & Sons. London, England: Chapman & Hall, Ltd. Cloth; 5¾ x 9¼ ins.; pp. 337; 51 illustrations in the text, and 24 tables. $3.50; English price, 15s., net.

A long service in the official testing of gas and gas meters gives Mr. Stone special qualifications for the treatment of the subject on which he has written. Mr. Stone was, first, an assistant inspector for the Gas and Electric Light Commission of Massachusetts. With the organization of the Public Service Commission of the Second District, State of New York, he became Chief Inspector of Gas for that commission, which position he has since held. It is therefore not surprising that the parts of the book which deal with the apparatus and methods employed for determining the illuminating and calorific values of gas, the extent to which it contains impurities subject to legal restrictions, and its chemical composition, and the determination of the accuracy of registration of gas meters are generally well written and certain to be of value to the managers of medium-sized and small gas companies.

With the present tendency to place public utilities under the supervision of state commissions, such companies as have not actually been brought under this supervision are liable to meet that fate at almost any session of the legislature of their state. In view of this, their managers are naturally interested in the regulations to which they are, or may be, subject and the means by which to determine whether the regulations are being observed. As a rule, these managers have had no opportunity to make a study of the testing of gas and gas meters and will find in this book very useful and welcome information.

The general subject has been divided by the author into the subdivisions of (1) Photometry; (2) Chemical Tests; (3) Calorimetry, Specific Gravity and Pressure; and (4) Testing of Meters.

The first part of the book contains descriptions of the photometers and the standards of light and standard burners used in testing the illuminating power of gas, together with directions for making such tests, both when using candles and when using other primary and secondary standards of light. It is concluded by a chapter entitled "Interpretation of Results," in which the author ventures into the realm of the manufacture of illuminating gas, where he is not entirely at home.

The second part contains descriptions of apparatus used for determining the extent to which impurities are present in illuminating gas, and also of apparatus for making a complete chemical analysis of such gas. Much of this latter portion is devoted to the Hinman gas-analysis apparatus. The author praises this highly and regrets that it is comparatively unknown to gas analysts.

The third part takes up the description of the instruments and methods employed for determining the calorific value of illuminating gas and also those used in determining the specific gravity and pressure of such gas.

The fourth part is devoted to a description of the apparatus and methods used in testing the accuracy of registration of the meters employed for measuring the amount of gas supplied to consumers. An appendix contains a number of tables, many of which are new.

The book is, to a certain extent, written from the standpoint of the official gas tester, although the author has tried to be impartial as between the public and the gas company. There are several slight errors and omissions, to a few of which attention may be called.

The value of the light given by the Hefner amyl-acetate lamp is given as 0.88-candle. This is the value which was formerly thought to be correct, but with the new international value for candle power recently adopted the value of the Hefner is 0.90-candle.

In describing the use of candles in making a photometrical test the author states that the "glowing end of one wick should point towards the disk, and that of the other towards the observer, thus the two wicks form a right angle with each other." This relative position of the wicks of the candles complies with the rule that the planes of the wicks should be at right angles to each other, but it is not the one adopted by the best photometricians. They invariably place the plane of each of the candle wicks at an angle of 45° with the plane of the disk.

In treating the question of the limit to be set upon the total amount of sulphur compounds which the gas shall be permitted to contain, no mention is made of a series of very careful tests as to the effect upon the atmosphere of a room of the combustion in it of gas containing a relatively large amount of sulphur compounds made some years ago for the South Metropolitan Gas Co., of London, England. Similar tests have since been made in Massachusetts. These tests show that the amount of sulphur in the air of the room in which such gas is being burned is very little, if any, greater than the amount in the outside air. The reason for this is that the air currents produced by the burning of the gas cause the products of combustion to come into contact with the plaster on the walls and ceiling of the room, which absorbs the sulphur compounds in these products. If the sulphur compounds in gas do not increase the sulphur content of the air in rooms in which the gas is burned, there is no good reason for insisting upon their removal to the extent that is often required.

These errors and omissions notwithstanding, the book will make a valuable addition to the libraries of those interested in the manufacture and sale of illuminating gas.

THE RISE AND PROGRESS OF THE BRITISH EXPLOSIVES INDUSTRY.—Published under the auspices of the 7th International Congress of Applied Chemistry, by its Explosives Section. London, England: Whittaker & Co. Cloth; 7½ x 10 ins.; pp. 418; 40 illustrations, partly in the text. $5.25, net.

The development of the explosive is coincident with the development of civilization. Just how much of cause and effect there is in this is hard to discern, though the death of the feudal system and the consequent political renaissance was without doubt quite largely the immediate result of the widespread use of gunpowder. Today industrial and political progress is perhaps not so wrapped up in the explosives industry, but even now the power of enormously expensive armies and navies is only the power of the powder in their guns. In view of this relationship between things material and the explosive with which outwardly they seem to have little in common, the history of the early days of the industry will have much of interest even to the laity. To the trade and to the experts engaged in the trade the record of the beginnings of the business will have more than passing interest.

The book noted above is the joint product of a number of authorities on the subject and on account of this multiple authorship does not attempt to preserve unity of treatment. It is a series of papers, fairly consecutive, in which the hitherto hidden stories of the development of the explosives trade are given. The titles of the chapters, as follows, will probably give the best idea of the contents: History of Gunpowder, Researches of Gunpowder, Nitrocellulose, Nitro-Glycerine, Permitted Explosives, Percussion Caps, Safety Fuses, Fireworks, Legislation, Bibliography and Chronology.

In the latter part of the book there are given short descriptions of all the public and private explosives factories on the British Isles.

THE SMOKELESS COMBUSTION OF COAL IN BOILER PLANTS.—With a Chapter on Central Heating Plants. By D. T. Randall and H. W. Weeks. Bulletin 373, U. S. Geological Survey; George Otis Smith, Director. Washington, D. C.: Pub. Doc. Paper; 5¾ x 9 ins.; pp. 188; 40 text illustrations and 57 tables.

The Geological Survey has studied the practice of burning bituminous coals in commercial plants in some 500 cities in the states of New York, Illinois, Indiana, Kentucky, Maryland, Michigan, Missouri, Ohio and Pennsylvania to ascertain the possibilities of general burning such coal without objectionable smoke. The results of this study are embodied in numerous tables of this bulletin. The conclusions to be drawn from all this data were summarized in Engineering News, July 8, 1909, and in brief, were to the effect that high-volatile coal not only could be burned without objectionable smoke, but also could be so burned in plants carrying a widely fluctuating load.

Municipal Administration.

CHAPTERS ON MUNICIPAL ADMINISTRATION AND ACCOUNTING.—By Frederick A. Cleveland, Ph. D., Director of the Bureau of Municipal Research. New York, London and Bombay: Longmans, Green & Co. Cloth; 5¼ x 8 ins.; pp. 361. $2, net.

For many years past the author of this volume has been one of the leaders in a strong movement for reform in American municipal accounting. His work from the start has been so largely of a practical character as to differentiate it from the opprobrium which many people seem to think attaches to the efforts of reformers. In the last few years, as one of the directors of the Bureau of Municipal Research, Mr. Cleveland has both deepened and broadened his work, and at the same time made it even more practical through its application to greatly needed changes in the accounting system of the city of New York. Under the conditions just outlined, Mr. Cleveland has had many opportunities to present addresses and papers both on the general subject of municipal accounting and administration and on such phases of those topics as apply to New York City. These papers and addresses have been brought together in the book before us now. All of them are comparatively recent. Although a large percentage of the total contents of the book has to do with New York City, yet most of the papers and addresses relating primarily to New York, or designed to instruct audiences in that city, are of almost equal application elsewhere.

In attempting to give the author's general point of view, perhaps we cannot do better than to quote from the preface, as follows:

> There is a growing appreciation of the fact that democracy, if successful, must be informed. The officer is asked not only to be true to his trust, but also to lay before the citizen a full and prompt account of all matters concerning which the public has a right to know. Efficiency as well as fidelity is demanded of him who is given public position and public honors.
>
> Four fundamental principles of government have been established as a result of experience.
>
> (1) Effective cooperation must be based on intelligence.
>
> (2) Officers, whether democratic or autocratic, can exercise intelligent direction over affairs only when fully apprised of the business to be administered.
>
> (3) Organized democracy can be made effective only so long and so far as it provides the means of regularly and currently bringing before its citizens the facts necessary to the exercise of the best judgment with respect to the fidelity and efficiency of those in positions of trust.
>
> (4) When the public may have the same information concerning public affairs that each member has concerning his private affairs there is no cooperative activity required for the highest welfare of a community that may not only be undertaken with advantage to the people but with honor to the trusted corporate servants.

In concluding his preface the author makes an apology, so far as one is needed, for reprinting so many more or less unrelated papers, as follows:

> Although prepared for many popular and successful bodies, differing widely in their special interest to the historian and publicist, and more particularly to the beginner, there may be a significance in these fragments that a systematic treatise could not have at this time of pioneer work and pioneer thinking toward constructive municipal reform.

It is true that for consecutive reading there is a large amount of repetition in the volume, but until the underlying principles set forth by the author are more generally understood and appreciated they will bear repeating. We look forward to the time, and hope it will not be far distant, when Mr. Cleveland will undertake the systematic treatise at which he hints in the last of the paragraphs quoted.

As to the book as a whole, it may be noted that, while it takes up many phases of municipal administration, it centers for the most part in accounting and related problems. At the same time, the need for physical and other operative statistics, as well as accounting figures and conclusions, is always kept in mind by the author, and often forcibly presented.

*Consulting Engineer, 58 William St., New York City.

An Elementary Text Book on Gas Engines.

Reviewed by LIONEL S. MARKS,* M. Am. Soc. M. E.

GAS ENGINE THEORY AND DESIGN.—A. C. Mehrtens, Instructor in Mechanical Engineering, Engineering School, Michigan Agricultural College. New York: John Wiley & Sons. London, England: Chapman & Hall, Ltd. Cloth; 5 x 8¼ ins.; pp. 256; numerous illustrations in the text. $2.50; English price, 10s. 6d., net.

The general field covered by this book is satisfactorily indicated by the title, but the treatment is everywhere superficial and elementary. In his preface the author says it is his aim "to make the treatment clear and concise and for this reason every paragraph should be studied—not merely read over." However, he says: "It is hoped that this book will enable every earnest student to acquire a foundation upon which he may eventually build a broad and comprehensive knowledge of the subject." Judged by the standard which is here invited, or indeed by any reasonable standard, the book is full of defects. The primary definitions are extraordinarily poor and entirely unfit as foundations; the arrangement of certain parts of the work is illogical and confused and the worst possible model for the student, for whom training in clear thinking is more important than any one other thing. The baneful influence of loosely written and confused text books cannot easily be exaggerated.

The following are some examples of the author's definitions and statements:

Heat may be defined as a form of energy which makes us do work. * * * The sensation of heat is supposed to be caused by the rapid vibration of the molecules of a body. * * * The terms "heat" and "expansion" are practically synonymous. * * * The intensity of heat radiated from any source * * * changes as the inclination of rays to the surface changes. * * * Soule's experiments proved * * * that there is a constant and definite relation between the amount of work that can be done by a certain amount of heat and vice versa. * * * In the air thermometer the temperature is indicated by a drop of mercury resting on a column of air. * * * Chemical action is most energetic between dissimilar substances.

In the combustion of fuels it is asserted that all fuels, solid or liquid, are first changed into a gas by rise of temperature before burning can take place. The heat of combustion of a compound, it is stated, is the sum of the heats of combustion of its constituent elements, after subtracting as much hydrogen as would be required to combine with whatever oxygen is present in the compound—that is, the author ignores the heat of formation of the compound. The chemical formulas for methyl and ethyl alcohol and the heat of combustion of the latter are apparently taken from a recent text-book without verification; they will spread further the gross errors of that book.

As an example of the lack of clear thinking, the first two paragraphs of Chapter VIII. may be presented. The chapter is on gas-engine efficiency.

In a discussion of the efficiency of the gas engine certain factors must be considered. Among the factors to be discussed are: Reliability, economy, advantages, disadvantages.

RELIABILITY.—The desirability of installing gas power depends much upon the reliability of the engine, and into the question of reliability enter a number of considerations, among which are cost, overload and underload capacity, proper handling, etc.

What is the student to conclude from the following sentences, taken from consecutive paragraphs:

The actual expansion of a gas takes plan according to the formula $P V^n = a$ constant, in which n is the ratio of the specific heat of the gas. In practice, for obvious reasons, the value of n will vary more or less from the theoretical values 1.405 [for air].

The foregoing examples should suffice to demonstrate the principal defects of this book. The author is obviously very much more at home when dealing with machine design than with general gas-engine theory. His treatment of gas-engine design consists almost entirely of statements as to gas-engine practice and empirical formulas for the design of the parts. It is satisfactory for a working reference book on such design, but it gives practically nothing of underlying principles. The book cannot be recommended as a satisfactory text book for technical schools or for those who desire an intimate knowledge of the gas engine. The drawings of details of small engines and the simple

*Assistant Professor of Mechanical Engineering, Harvard University, Cambridge, Mass.

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formulas for the design of parts should be of some use to those who desire to try an apprentice hand at the design of small engines—though even here it must be remembered, as the author points out, that "the designing of a gas engine . . . is largely a matter of experience and judgment."

Railway Estimates.

RAILROAD STRUCTURES AND ESTIMATES.—By J. W. Orrock, Structural Engineer. New York: John Wiley & Sons. London, England: Chapman & Hall, Ltd. Cloth; 5¾ × 9¼ ins.; pp. 270; 94 illustrations in the text. $3, net; English price, 12s. 6d., net.

Estimating the cost of work is always a matter of more or less difficulty, especially to the younger engineer with no wide range of experience to govern his judgment. The approximately exact cost is desired, but there must be a margin or "factor of safety" to provide for contingencies. Nothing but experience and good judgment can enable an estimator to decide how close to cut his figures. If the estimate is too high, it may be regarded as the result of carelessness or extravagance; if it is too low and is exceeded by the actual cost, there is trouble for the estimator. Under such conditions, any information as to actual or average costs is eagerly sought.

For instance, in making an estimate it may be extremely desirable to know what is the average cost of a railway station of certain size; or what is an average cost for a culvert, a retaining wall, a timber trestle, or a tunnel. Of course such figures are to be considered merely as guides. In many cases they may be actual figures, but based on structures varying somewhat from the case in hand, and varying also in geographical or other conditions which affect the cost of labor or materials. In other cases, the figures may be averages for a number of structures and may cover a wide variety of conditions.

In the book under review, there is given a summarized description of numerous railway structures, with the information as to costs, weights and quantities of material, etc., and in some cases particulars as to the items and unit prices upon which the costs are based. In many cases a lump sum is given for total cost; in others, there is a cost per unit (per square foot for buildings, or per lineal foot for trestles of varying heights, etc.). The book relates largely to Canadian practice (and presumably Canadian prices).

The book is not a mere compilation of prices and costs, but contains a large amount of descriptive matter. Owing to its wide range, however, the treatment of any one subject is necessarily condensed and the style is such as to be possibly misleading in some cases by implying a uniformity in practice which does not exist. For instance, in regard to bridge guards, it is stated that the "ordinary" wood guard consists of two timbers outside of each rail, and the only inside guard-rail system mentioned is the Jordan triple-rail guard, which is used only by comparatively few roads. In this country, the ordinary practice is to use a single outside guard timber on each side, and an inside steel guard rail near each track rail. In regard to retaining walls, also, nothing is said as to the cost of concrete walls (now used very extensively). For masonry walls, the cost is given as ranging from $8 to $25 per cu. yd., which is not a very great help to an estimator. For many other structures, however, itemized estimates are given.

The first two chapters relate to grading, track material, fences, crossings, cattleguards, and track signs. A short chapter on culverts gives capacities of flow, quantities of material, and costs per foot for culverts of various kinds. A longer chapter deals mainly with trestles and bridges, but includes some notes on bridge piers, cribs, retaining walls and tunnels. This has several tables of weights and costs of steel bridges of different types and spans, quantities of masonry in bridge piers, and quantities and cost for timber and steel trestles of different heights. Another long chapter deals with water-supply and water stations, the capacities of pumps, cost and weight of pipe, and gives hydraulic information. These five chapters cover about 120 pages.

Buildings and structures are dealt with at some length in two chapters, covering about 100 pages. These include stations, section houses, snow sheds, engine houses, oil and ice houses, cold storage buildings, coaling stations, stock yards, locomotive and car shops, etc. In addition to the structures themselves, there is information regarding such special equipment as the lighting and heating plant of engine houses, refrigerating and ice-making plants, etc. The other matter includes a chapter of notes on estimating, with units of work and prices for various classes of work.

A strange and disappointing feature of the book is the absence of any instruction or advice as to the preparation of estimates. It is true that there is a chapter of nearly 30 pages on "Instructions regarding specifications, proposals, contracts, plans and estimates," but over 20 pages of this are occupied with lists of specifications, a form for estimates, and a form of general contract, as used by the Canadian Pa-

A Review of

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BY

LEON S. MOISSEIFF

A. M. Am. Soc. C. E.

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cific By. A good chapter on estimating would have added very materially to the usefulness of the book. The typographical work is good, but much space (approximately 15 pages) is wasted in blank pages and half pages at various points (not at the ends of chapters) where the type matter might better have been inserted, so as to make the book more compact. The book is a very useful one (in spite of its weak point in the omission of matter on estimating), but the user should thoroughly appreciate the necessary limitations of any book dealing with the "uncertain quantity" of prices and costs.

BOARD OF PUBLIC WORKS (Poughkeepsie).—Rules and Regulations Relating to the Construction and Repair of Sidewalks, Curbs and Gutters. (Robert J. Harding, Superintendent of Board.) Poughkeepsie, N. Y.: The Board. Paper; 6¼ × 9½ ins.; pp. 20; 19 plates.

A number of views designed to illustrate engineering practice regarding sidewalks, curbs and gutters in various cities are first given. These are followed by some sections of stone and of concrete curbs, and also of sidewalks. Some of the sections are general designs used in Poughkeepsie "to meet present conditions." A few pages of text give the policy of the Board as to uniform requirements for curbs, gutters and sidewalks, including the character of the material to be used. Brief specifications for "Portland cement sidewalks" are also given. A preface to the text states that the pamphlet has been prepared "for criticism by those competent to criticize, and to instruct those not competent."

SIMPLIFIED METHODS OF CALCULATING REINFORCED-CONCRETE BEAMS.—By W. Noble Twelvetrees, M. Inst. M. E., Assoc. M. Inst. E. E., Author of "Concrete-Steel," etc. London and New York: Whittaker & Co. Paper; 5 × 7¼ ins.; pp. 20; nine illustrations, mostly in the text. 6d., net; American price, 25 cts.

The main part of this little book is devoted to a description of a calculating device, invented by the author, by means of which the sizes and stresses of reinforced-concrete beams may be computed. This device is merely a series of curves mounted on heavy cardboard and provided with a sliding runner and a pivoted bar to aid in the following of the lines and points. In the first part of the discussion there is a tabulation in which the numerous formulas for reinforced-concrete beam design are reduced, first, to similar nomenclature and, second, to groups of identical formulas. While it has been recognized that such formulas owe their diverse appearance to individual nomenclature, this standardization does much to simplify the many methods of computation advanced by various authorities.

HARPER'S MACHINERY BOOK FOR BOYS.—By Joseph H. Adams, Author of "Harper's Electricity Book for Boys," etc. New York and London: Harper & Brothers. Cloth; 5½ × 9 ins.; pp. 373; one plate and numerous text illustrations. $1.75.

As a book telling of machinery in language easily understood, this volume will be read with interest by any boy of an inquisitively mechanical turn of mind. Its chief value will be in imparting a sort of general familiarity with mechanical principles and their applications and in giving a general idea of the way in which many forms of prime movers work. It is true that directions are given in detail for the construction of several machines, but in most cases the size and elaborateness of these machines will place their construction quite beyond the resources of the average boy reader.

The most prominent fault of the book is the inclusion of numerous general statements, quite unnecessary to the purpose of the book, which are not only in many cases misleading but often quite untrue. For example, in Chapter III., a list of modern feats of engineering includes "the Blackwell's Island cantilever bridge (the longest and highest in the world)." We learn also, in the chapter on water-power, that

> when steam first came into general use, and later was largely superseded by electricity, it seemed as though water-power was to be laid aside forever. But when the harnessing of Niagara became an engineering possibility, . . . old ideas were again brought to the front, and to-day the methods of centuries ago are being readopted.

Such statements occur only in the introductory paragraphs of the various chapters and do not, of course, impair the descriptive and explanatory matter comprising the bulk of the book.

STEAM TURBINES.—A Book of Instruction for the Adjustment and Operation of the Principal Types of This Class of Prime Movers. Compiled and Written by Hubert E. Collins. New York and London: Hill Publishing Co. Cloth; 4½ × 7 ins.; pp. 186; 76 illustrations in the text. $1.

The Curtis and Parsons types of turbine are explained in this book from the standpoint of the man who must operate them and keep them in adjustment. The constructive details which would present some novelty to the engineer of a power plant with engines of the reciprocating type, as, for example, the step bearing of the vertical Curtis turbine, are described in detail, with an explanation of necessary care and adjustments. Two chapters are devoted to the testing of turbines. Like the rest of the book, they are written from the operator's standpoint and deal with mechanical features, such as means of applying a test load and preliminary examinations of the turbine and auxiliaries rather than with the theoretical features of the tests. Of the two final chapters, the first de-

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There are comparatively few engineers who do not have frequent use for a Slide Rule; there are probably none who do not make frequent use of a table of logarithms; yet there are few of these users who realize the many forms of slide rules and calculators that have been placed upon the market or who know much regarding the history of the instrument. In the list compiled by Prof. Cajori, there are 256 instruments, many of which, have been designed for special purposes; in fact, the slide rule has been adapted to almost every branch of the arts in which calculation is required and has been of greater general interest than any other device for minimizing mental labor in computation. The illustrations show the development of the slide rule from its invention—some of them have been reproduced from the originals in early eighteenth century books. Every Engineer and Every Library should have this book.

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One cannot but admire the painstaking industry shown by the late Colonel Moore in compiling his original bulky volume and by Mr. Silcock in revising and partly rewriting the book and extending it to make two volumes of large size. Lest we mislead, we may add that the book is not wholly a compilation, although, except for the extensive hydraulic tables prepared by Colonel Moore, it contains relatively little original matter.

Only a small part of the field of sanitary engineering is covered by the work, which is little more than a treatise on sewerage and sewage disposal. In addition, there are about 85 pages on refuse destructors, and some notes on disinfectants and disinfection, and also on soils and subsoils.

The book being a re-edition and being confined almost wholly to British practice and devices, it is unnecessary to take up its contents in detail. It contains an abundance of illustrations, including sewer pipe joints, sewer cleaning devices, traps, automatic sewage-discharging apparatus and sewage sprinklers for filter beds, besides details of sewerage and drainage work and plans and details of sewage treatment plants and of refuse destructors.

Save for references to reinforced-concrete sewers at Harrisburg, Pa., and Cleveland, Ohio (printed "Clevedon"), and to the Massachusetts studies of chemical precipitants, American practice and ideas appear to be ignored, but Continental Europe fares little, if any better.

The two hundred and more pages on sewage treatment seem to be by far the most useful part of the book for American engineers. The text here, as elsewhere, is mostly a compilation, but this appears to have been well done. The reports of the present Royal Commission on Sewage Disposal are digested. Apparently up-to-date descriptions of a number of British sewage works are included. A brief appendix contains Local Government Board regulations of 1909 for the design of sewage works.

The convenience and pocketbooks of those who desire to possess some but not all the information given in these two large and costly volumes would be served by dividing them into three or four. The matter on sewerage, as distinct from disposal, would make a sufficiently large volume in itself. The use of the hydraulic tables would be greatly facilitated if they were in a separate volume. The matter on sewage treatment would make a volume of respectable and convenient size, which might perhaps have a relatively large sale. The chapters on refuse destructors would make but a thin book. They might be so published, or they, together with the remainder of the contents of the two present volumes, might be abandoned entirely.

COMMISSION ON INDUSTRIAL EDUCATION.—Report Submitted to the Senate and General Assembly of the State of New Jersey, in Accordance with Joint Resolution No. 11, Approved April 14, 1908. (Albert A. Snowden, Secretary of Commission.) Trenton, N. J.: Pub. Doc. Paper; 5½ × 9 ins.; pp. 177; one plate.

The New Jersey commission on industrial education was appointed by Gov. Fort in May, 1908, in accordance with a joint resolution of the Senate and General Assembly to investigate thoroughly the needs of the industries in respect to industrial and technical training, to study the extent to which these needs are at present met, and to offer definite suggestions as to how the promotion of industrial education may best be undertaken for the best interests of the commonwealth and its citizens.

As a result of its investigations the commission recommends that the general supervision and control of public industrial education be vested in a Commission on Industrial Education, consisting of five citizens of New Jersey, at least three of whom shall be engaged in industrial pursuits, their term of office to be five years, and that whenever any municipality in the state raises a sum of money not less than $1,000 for the establishment of a school or schools of industrial education, that municipality will receive an equal amount from the state, though no contribution from the state is to exceed $7,000. No definite form of industrial institution is recommended as the scope and curriculum will be decided by the industries of the locality in which the institution is to be established.

The larger part of the report is devoted to five valuable appendices on the following subjects: industries—conditions and needs; the agricultural industry—conditions and needs; the money value of industrial training; industrial education and manual training in America; and, some observations on industrial training in Europe.

ELECTRIC RAILWAY POWER STATIONS.—By Calvin F. Swingle. Chicago, Ill.: Frederick J. Drake & Co. Cloth; 5¼ × 8 ins.; pp. 718; 368 illustrations, mostly in the text. $2.

The author might have broadened his title so as to include all power stations, as what is written applies with nearly equal force to stations generally. The descriptions of apparatus, on the market, covers the ground in much the same way as do the makers' bulletins. The discussions of underlying theories is attempted, where obviously necessary, in an elementary way. The recital of current practice is largely on practical methods of operation.

The book will not interest the engineer whose library holds the standard texts and who needs to delve deeper into the theory of design or the details of practice. But it should prove interesting and helpful for those in whose hands the actual operation of machinery is placed, and it should help them to a more comprehensive view of the system of which they are a part.

The book opens with a general description of the better known typical American water-tube boilers and a few others not so well known. Under the subject of "boiler construction" is found a detailed discussion of the strength of different riveted joints, with some few pages on staying. After telling what constitutes the proper care of boilers, for maximum safety and economy, the author describes more commercial apparatuses. These are the auxiliaries—feed-water heaters, condensers, feed pumps, etc.

The processes of the combustion of fuel, the need of boiler tests and of flue-gas analysis are discussed, after which the author proceeds to prime movers and electrical apparatus. Reciprocating steam engines are taken up in a general way. No commercial forms are discussed individually, as was the case with boilers and their auxiliaries, or as in what follows about steam turbines, gas engines, gas producers and electrical instruments.

BULLETIN OF THE BUREAU OF THE PERMANENT GENERAL COMMITTEE OF REPRESENTATIVES OF RUSSIAN RAILROADS.—Nos. 1 and 2, 1909 (in Russian). St. Petersburg: The Bureau. Paper; 7 × 9½ ins.

The Bulletin of the Bureau of Representatives of Russian Railroads is at present in its eighth year. It is published monthly in Russian and comprises about 78 pages of printed and illustrated matter. It covers the entire field of railway operation, the mechanical, maintenance-of-way as well as transportation features and railroad statistics. The information is apparently of local interest only.

A translation into the French of Dr. W. H. Tolman's "Social Engineering," reviewed in this Supplement for April 15, 1909, is announced for publication by Messrs. Vuibert & Nony, Publishers, 63 Boulevard St. Germain, Paris.

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ENGINE LATHE WORK.—Practical Suggestions Which Will Give the Young Machinist or Apprentice the Foundation Principles of Engine Lathe Work. By Fred H. Colvin, Associate Editor of "The American Machinist," Author of "American Machinists' Handbook" etc. New York and London: Hill Publishing Co. Cloth; 4½ × 7 ins.; pp. 180; 127 illustrations in the text. $1.

The principles on which are based the common practice of turning metals by means of the engine-lathe are stated in this book, but it is not for the restatement of what a good machinist already knows that the book will be most appreciated. It is rather for the "kinks," the makeshift attachments and ingenious ways of doing work, that the shop man will appreciate the volume.

PAVING BRICK AND PAVING BRICK CLAYS OF ILLINOIS.—By C. W. Rolfe, R. C. Purdy, A. N. Talbot and I. O. Baker. Bulletin No. 9, Illinois State Geological Survey. Urbana, Ill.: University of Illinois. Cloth; 5¾ × 8¾ ins.; pp. 316; 3 plates and 33 text illustrations.

This excerpt from the report of the Illinois Geological Survey contains seven papers on "Geology of Clays," "Geological Distribution of Paving Brick Materials in Illinois," "Qualities of High Grade Paving Brick and Tests Used in Determining Them," "Qualities of Clays Suitable for Making Paving Brick," "Pyro-Physical and Chemical Properties of Paving Brick Clays," "Clays Tested Which Are Suitable for Use in the Manufacture of Paving Brick" and "Construction and Care of Brick Pavements," respectively.

Publications Received.

ADDRESS OF PRESIDENT C. N. GODDARD, OF THE NATIONAL FIRE PROTECTION ASSOCIATION.—At the Annual Meeting, New York City, May 25, 1909. Paper; 5¾ × 9 ins.; pp. 10.

ADMINISTRATION REPORT OF THE IRRIGATION BRANCH OF THE PUBLIC WORKS DEPARTMENT IN THE MADRAS PRESIDENCY.—For the Year 1907-08. Madras, British India: Pub. Doc. Boards; 8 × 13¼ ins.; pp. 228; folding and other plates. 5s. 6d.; American price, $2.20.

THE ADVENTURES OF A CIVIL ENGINEER.—Fifty Years on Five Continents. By C. O. Burge, M. Inst. C. E. London, England: Alston Rivers, Ltd. Cloth; 5½ × 8¾ ins.; pp. 320; eight plates. 7s. 6d., net; American price, $3.

AMERICAN INSTITUTE OF ARCHITECTS.—Proceedings of the Annual Convention Held at Washington, D. C., Dec. 15-17, 1908, and the Memorial Meeting in Appreciation of Augustus Saint-Gaudens at the Corcoran Gallery of Art. Washington, D. C.: The Institute (Glenn Brown, Editor). Paper; 7¼ × 9¾ ins.; pp. 271.

AMERICAN WATER WORKS ASSOCIATION.—Proceedings of the Annual Convention Held at Washington, D. C., May 11-16, 1908. Published by the Secretary (J. M. Diven, 14 George St., Charleston, S. C.). Cloth; 5¾ × 9¼ ins.; pp. 778; folding and other plates, and numerous text illustrations.

ANNUAL STATEMENTS OF THE RAILROAD AND CANAL COMPANIES OF THE STATE OF NEW JERSEY.—Together with Report of State Director of the United New Jersey Railroad and Canal Co. for the Year 1908. (Joshua E. Borton, State Director.) Trenton, N. J.: Pub. Doc. Cloth; 5¾ × 9¼ ins.; pp. 259; one folding sheet.

BRIQUETTING TESTS AT THE UNITED STATES FUEL-TESTING PLANT, NORFOLK, VA., 1907-08.—By Charles L. Wright. Bulletin 385, U. S. Geological Survey; George Otis Smith, Director. Washington, D. C.: Pub. Doc. Paper; 5¾ × 9 ins.; pp. 41; nine plates.

BULLETINS, U. S. GEOLOGICAL SURVEY.—George Otis Smith, Director. Washington, D. C.: Pub. Doc. Paper; 6 × 9¼ ins.

No. 341: Contributions to Economic Geology, 1907. Part II.—Coal and Lignite. Marius R. Campbell, Geologist in Charge. Pp. 444; 25 plates and 7 text figures.

No. 375: The Fortymile Quadrangle. Yukon-Tanana Region, Alaska. By L. M. Prindle. Pp. 52; five plates (two in pocket) and two text figures.

No. 379: Mineral Resources of Alaska. Report on Progress of Investigations in 1908. By Alfred H. Brooks and Others. Pp. 418; 10 plates and 21 text figures.

No. 380: (Advance Chapters.) Contributions to Economic Geology, 1908, Part I. 380-A: Investigations Relating to Gold and Silver, by the U. S. Geological Survey in 1908; by J. M. Hill, F. L. Ransome, J. S. Diller, G. F. Kay, D. F. MacDonald, and J. T. Pardee; pp. 80; two plates and five text figures. 380-D: Investigations Relating to Rare Metals, by the U. S. Geological Survey in 1908; by Frank L. Hess; pp. 40; one text figure. 380-E: Investigations Relating to Iron and Manganese, by the U. S. Geological Survey in 1908; by E. F. Burchard, E. C. Harder and Sidney Paige; pp. 115; 14 text figures.

BUREAU OF SCIENCE (Philippine Islands).—Annual Report of the Director to the Honorable the Secretary of the Interior. By Paul C. Freer, Director of the Bureau of Science. For the Year Ending Aug. 1, 1908. Manila, P. I.: Pub. Doc. Paper; 7¼ × 10¾ ins.; pp. 81; one folding sheet.

BY-LAWS OF THE ASSOCIATION FOR THE DEFENSE OF SEPTIC PROCESS SUITS.—Adopted May 29, 1909. (George A. Johnson, Secy., 170 Broadway, New York.) Paper; 6 × 9 ins.; pp. 7.

CHOOSING A VOCATION.—By Frank Parsons, Ph. D., Late Director of the Vocation Bureau and Breadwinners' Institute, Civic Service House, Boston, Author

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of "Youth and the World," etc. Boston and New York: Houghton, Mifflin Co. Cloth; 5 × 8¼ ins.; pp. 165. $1, net.

COMMISSIONER OF DAMS AND RESERVOIRS (Rhode Island).—Annual Report Made to His Excellency Aram J. Pothier, Governor, January, 1909. (Walter C. Simmons, Commissioner.) Providence, R. I.: Pub. Doc. Paper; 5¾ × 9 ins.; pp. 17; folding and other plates.

CONNECTICUT SOCIETY OF CIVIL ENGINEERS.—Papers and Transactions for 1908, and Proceedings of the Annual Meeting at Hartford, Feb. 9-10, 1909. (J. Frederick Jackson, Secy., New Haven, Conn.) Paper; 6 × 9¼ ins.; pp. 174; text illustrations.

DEPRECIATED CURRENCY AND DIMINISHED RAILWAY RATES.—An Inquiry Conducted by the "Railway World" for the Purpose of Ascertaining the Opinions of Leading Economists and Publicists Concerning the Propriety of an Adjustment of Railway Rates to the Diminished Value of the Money in Which They Are Paid. Philadelphia, Pa.: "Railway World" (Witherspoon Building). Paper; 5¾ × 9 ins.; pp. 127.

DIFFERENTIAL METHODS FOR DETECTING THE TYPHOID BACILLUS IN INFECTED WATER AND MILK.—D. D. Jackson and T. W. Mella. (Reprinted from "The Journal of Infectious Diseases," Vol. 6, No. 2. April 1, 1909. Paper; 6½ × 9½ ins.; pp. 194 to 204; two illustrations in the text.

DIRECTORY OF DIRECTORS IN THE CITY OF NEW YORK.—New York: The Audit Co. (165 Broadway). Cloth; 5¼ × 8 ins.; pp. 860. $5.

DIE EISENBETONKUPPEL DER FRIEDRICHSTRASSENPASSAGE IN BERLIN.—By Siegmund Müller, Professor in the Technical College at Berlin. (Reprinted from 'Armierter Beton," 1909.) Berlin, Germany: Julius Springer. Paper; 7½ × 10½ ins.; pp. 24; 27 illustrations in the text. 0.80 marks; American price, 40 cts.

ELECTRICAL INDUSTRIES OF PORTO RICO, 1907.—Bulletin 99, Bureau of the Census; S. N. D. North, Director. Washington, D. C.: Pub. Doc. Paper; 9¼ × 11½ ins.; pp. 29.

ENGINEERING ASSOCIATION OF THE SOUTH.—Transactions, 1908. Vol. XIX. Edited by the Secretary, under Direction of Committee on Papers and Printing. Nashville, Tenn.: The Association (H. H. Trabue, Secy., Carnegie Library). Paper; 5¾ × 9 ins.; pp. 220; folding plates and text illustrations. Proceedings and Transactions, $5 per year.

DIE FOERDERUNG VON MASSENGUETERN.—By Georg von Hanffstengel, Leipzig, Privatdozent in the Royal Technical College at Berlin. Vol. II.: Förderer für Einzellasten. Berlin, Germany: Julius Springer. Paper; 6¼ × 9¼ ins.; pp. 267; 445 illustrations in the text. 1.6 marks; American price, 75 cts.

GEOLOGIC ATLAS OF THE UNITED STATES.—U. S. Geological Survey, George Otis Smith, Director. No. 166, El Paso Folio: Texas. Washington, D. C.: Pub. Doc. Stiff paper; 18¾ × 21¾ ins.; pp. 11; three plates and eight text illustrations.

GEORGIAN BAY SHIP CANAL.—Report upon Survey, with Plans and Estimates of Cost, 1908. (Eugene D. Lafleur, Chief Engineer.) Sessional Paper No. 19a, Department of Public Works, Canada. Ottawa, Can.: Pub. Doc. Paper; 6½ × 10 ins.; pp. 601; folding plates and text illustrations; 56 plates in three separate board folios, and 24 half-tones in separate paper binding, 6½ × 10 ins.

THE GROWTH OF THE SEWAGE DISPOSAL IDEA IN AMERICA.—What Constitutes Proper Disposal. An Address Delivered before the Commercial Club and the Board of Trade of Indianapolis, Ind., Feb. 19, 1909, by Alexander Potter, Consulting Engineer. New York: The Author (114 Liberty St.). Paper; 6¼ × 9¼ ins.; pp. 52; numerous illustrations in the text. $1.

ILLINOIS SOCIETY OF ENGINEERS AND SURVEYORS (Incorporated).—Annual Report, 1909. Proceedings of the Society at the Annual Meeting Held at Chicago, Jan. 27-29, 1909. Chicago, Ill.: The Society (E. E. R. Tratman, Secy., 1636 Monadnock Block). Paper; 5¾ × 9¼ ins.; pp. 287; text illustrations and one folding sheet. 50 cts.

INDIANA ENGINEERING SOCIETY.—Annual Report. Proceedings of the Society, Annual Meeting Held at Indianapolis, Ind., Jan. 16-18, 1908. Indianapolis, Ind.: The Society (Chas. Brossmann, Secy., Union Trust Building). Paper; 6 × 9 ins.; pp. 208; folding plates and text illustrations. 50 cts.

IOWA ENGINEERING SOCIETY.—Proceedings of the Annual Meeting Held at Des Moines, Iowa, Jan. 8-10, 1908. Iowa City, Iowa: The Society (A. H. Ford, Secy., Electrical Building). Paper; 6 × 9¼ ins.; pp. 129; text illustrations and one folding sheet. 50 cts., prepaid.

LESSONS IN TELEGRAPHY.—For Use as a Text-Book in Schools and Colleges and for Individual Students. By Charles Henry Sewall, Author of "Wireless Telegraphy," etc. New York: D. Van Nostrand Co. Cloth; 4¾ × 7½ ins.; pp. 88; 12 illustrations in the text. $1, net.

LIGHT AND SOUND.—A Text-Book for Colleges and Technical Schools. By William S. Franklin and Barry Macnutt. New York: The Macmillan Co. London, England: Macmillan & Co., Ltd. Cloth; 5½ × 8⅝ ins.; pp. 344; numerous illustrations in the text. $1.60, net.

METROPOLITAN WATER BOARD (London, England).—(Reports by Director of Water Examination). London, Eng.: The Board, (Savoy Court, Strand, W. C.). Paper; 8 × 13 ins.

Fourth Report on Research Work, by Dr. A. C. Houston, Director of Water Examination, Metropolitan Water Board, on The Vitality of the Cholera Vibrio in artificially infected samples of raw Thames, Lee and New River Water, with special reference to the question of Storage. Pp. 18.

Report on The Results of the Chemical and Bacteriological Examination of the London Waters for the Twelve Months ended 31st March, 1909, by Dr. A. C. Houston. Pp. 42.

MINISTER OF MINES (British Columbia).—Annual Report, for the Year Ending 31st December, 1908, Being an Account of Mining Operations for Gold, Coal, etc., in the Province of British Columbia. (Richard McBride, Minister of Mines.) Victoria, B. C.: Pub. Doc. Paper; 7½ × 10½ ins.; pp. 269; folding and other plates.

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OHIO ENGINEERING SOCIETY.—Proceedings, Annual Meeting, February, 1908. Columbus, Ohio: The Society (Paul Hansen, Secy.). Paper; 6 × 9 ins.; pp. 190; illustrated. 50 cts.

ON THE RATE OF FORMATION OF CARBON MONOXIDE IN GAS PRODUCERS.—By J. K. Clement. Bulletin No. 30, University of Illinois Engineering Experiment Station. Urbana, Ill.: The University. Paper; 6 × 9 ins.; pp. 47; 8 text figures and 21 tables.

PRESERVATION AND UTILIZATION OF THE NATIONAL FORESTS.—By Smith Riley, District Forester. (Proceedings of the Colorado Scientific Society, Vol. IX.) Denver, Colo.: The Society. Paper; 6¼ × 9½ ins.; pp. 159 to 180.

THE PRODUCTION OF SLATE IN 1908.—By A. T. Coons. With General Note on the Classification and Characteristics of Slate, by T. Nelson Dale. Advance Chapter from Mineral Resources of the United States (U. S. Geol. Survey), Calendar Year 1908. Washington, D. C.: Pub. Doc. Paper; 5¾ × 9¼ ins.; pp. 15; one folding table.

REMAKING THE MISSISSIPPI.—By John Lathrop Mathews. Boston and New York: Houghton, Mifflin Co. Cloth; 5 × 8¼ ins.; pp. 265; 16 plates and 1 text illustration. $1.75.

ROSE POLYTECHNIC INSTITUTE.—Memorial Volume, Embracing a History of the Institute, a Sketch of the Founder, together with a Biographical Dictionary and Other Matters of Interest. Terre Haute, Ind.: The Institute. Cloth; 5½ × 9 ins.; pp. 269; folding and other plates.

TABLES AND DIAGRAMS OF THE THERMAL PROPERTIES OF SATURATED AND SUPERHEATED STEAM.—By Lionel S. Marks, Assistant Professor of Mechanical Engineering, Harvard University, and Harvey N. Davis, Ph. D., Instructor in Physics, Harvard University. New York, London and Bombay: Longmans, Green & Co. Cloth; 6¼ × 9¼ ins.; pp. 106; 8 figures in the text and 2 folding diagrams in pocket. $1, net.

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Frank B. Gilbreth

Ancient as the art of bricklaying is, there has never been a *real* book on the subject before. Indeed, astonishingly little has ever been written about brick masonry, and, so far as the economics of the subject is concerned, nothing has heretofore appeared in book form. It is a large subject, and one of growing importance in spite of the advent of concrete. In fact, scores of concrete buildings are faced with brick, or have brick curtain walls.

Gilbreth's "Bricklaying System" is a book whose 330 pages are filled with rules and hints for his foremen and bricklayers, designed to increase the output of the workmen and to enable men of moderate skill to do difficult work in the best manner. There are 73 charts showing different bonds, ornamental and plain, some of which would be exceedingly hard to execute were it not for the methods explained in the text. To the architect, 73 ornamental charts alone will prove of great value, for practically none of them can be found in any other book, and no other book has more than 8 different bonds.

Among the many labor-saving devices and methods in this book, none is more worthy of comment than what Mr. Gilbreth calls his "packet system" of handling bricks. The bricks are piled on small, wooden trays or "packets," loaded onto wagons, hauled to the work and delivered to the bricklayers. This handling in units has worked a remarkable reduction in cost on Mr. Gilbreth's own work. Incidentally, by keeping tab on the number of empty "packets," the exact output of each bricklayer is recorded, which itself is a stimulus that works wonders in the output of the men.

The "fountain trowel" is another money-saving device. Space prohibits mention of more.

The book is now off the press, and, upon allowance of foreign copyrights (July 28), will be ready for distribution. Its size is 6 × 9 ins., 330 pages, 167 illustrations and 73 bond charts. The price is $3.00 net, postpaid.

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Announcement

I have turned over the publication of **GODFREY'S TABLES** to the **Myron C. Clark Publishing Co.**

About 50 copies of the first edition of this book are still in my possession. I will sell these at $1.25 each to anyone sending check or money order, and will send with each copy loose sheets of all new and revised tables in the second edition. The regular price of the book is $2.50. This is a standard book of structural tables for engineers and draftsmen, acknowledged to be the best in the English language.

I am still publishing **CONCRETE**, price $2.50, and **A MINORITY REPORT ON THE QUEBEC BRIDGE DISASTER**, price 20 cents. Send for Circular.

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